EGG SURFACE ULTRASTRUCTURE IN *MANTISPA INTERRUPTA* (NEUROPTERA: MANTISPIDAE)[1]

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ABSTRACT: The egg chorion of *Mantispa interrupta* was examined by scanning and transmission electron microscopy. The egg surface consists of reticulations connected by bridges that rise from the inner chorion surface. The egg stalk surface is featureless even at high magnifications. This same morphology is seen in the Chrysopidae, as reported by Hinton (1981).

The eggs of mantispids are white ovals on short stalks and are found on the undersides of exposed surfaces, such as leaves and anthropogenic structures (Kuroko 1961; Redborg and MacLeod 1983, 1984, 1985; Rice 1986). They greatly resemble those of Chrysopidae, except that the stalks are rarely more than 2-3 times the length of the egg and usually less. Illustrations of gross morphology are found in Hungerford (1936), Kuroko (1961), and Merti (1940).

METHODS

A female *Mantispa interrupta* Say was found on West Campus, University of Kansas, Lawrence, Douglas County, Kansas, on October 13, 1990, laying eggs on a slightly curled red leaf of a 3 m tall planted sugar maple (*Acer saccharum* Marshall). Accessible leaves were examined for 90 minutes, but no additional *Mantispa* were found. The *Mantispa* female was enclosed in a glass container with the sides lined with chromatography paper. Eggs were laid in the laboratory on October 15, 20, 27, 30, November 3, 9, 13. The female died November 14. Larval emergence was from 13-17 days after laying. Approximate egg counts were 200-300 per batch, with a total of about 1500.

Eggs to be fixed were cut out of the main batch of eggs along with the chromatography paper to which the stalks were fastened. Fixation was in 2.5% glutaraldehyde in 0.1 M, 7.3 pH sodium cacodylate buffer at room temperature for 1 hour, followed by fresh fixative at 4°C for 2-3 days. For scanning electron microscopy, eggs were then rinsed in buffer, run through a dehydration series of ethanol to 100% ethanol, then placed in two 10 minute changes of HMDS (hexamethyldisilazane) and air

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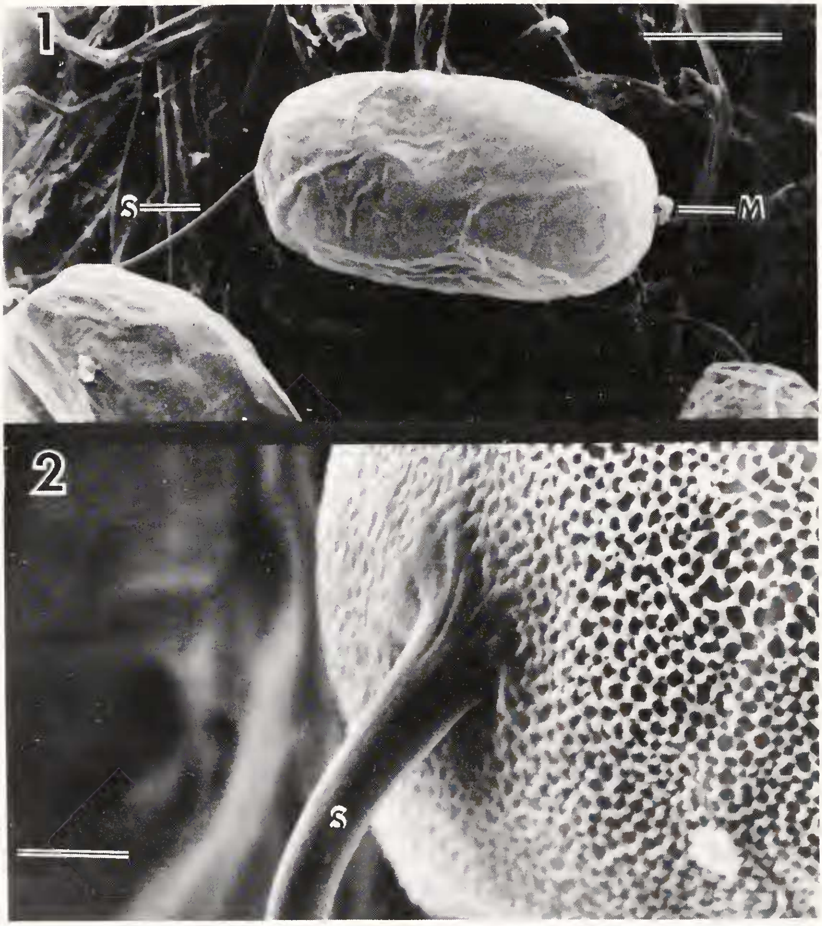
dried from the HMDS. Many eggs, regardless of developmental stage, were subsequently seen to be collapsed. A few remained intact, and these were the ones studied. In retrospect, critical point drying would probably have produced greater numbers of non-collapsed eggs. The paper containing the eggs was glued to a stub and sputter-coated with 200-250 Å of gold-palladium alloy. Specimens were examined with a Philips 501 scanning electron microscope.

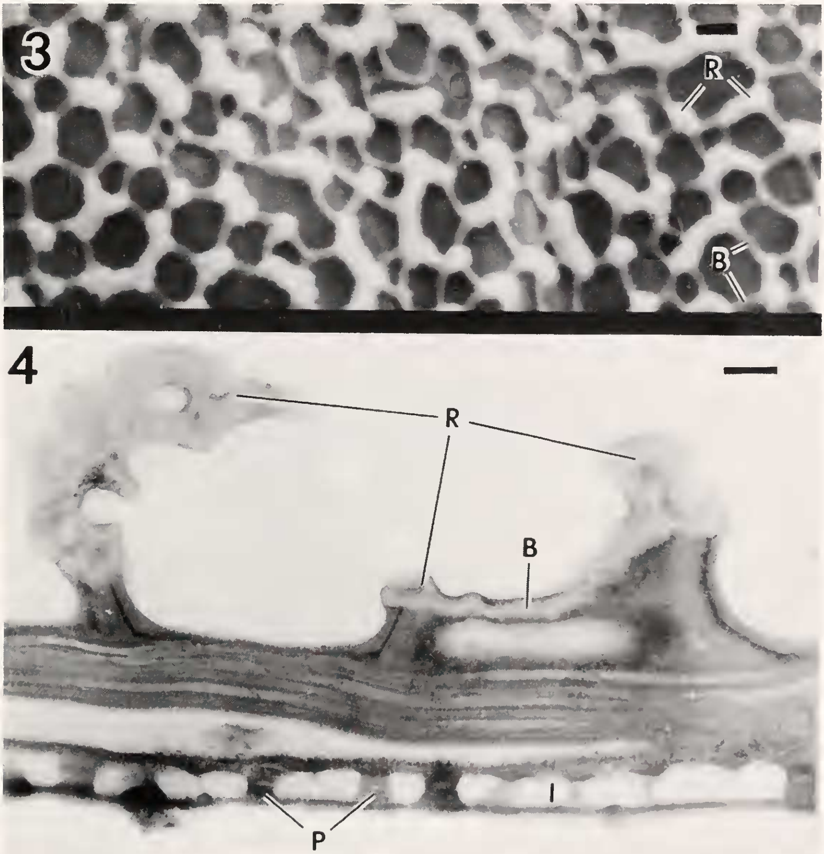
For transmission electron microscopy, eggs were rinsed in buffer, postfixed in 1% osmium tetroxide in the same buffer at 4°C for 2.5 hours. After rinsing in buffer, eggs were dehydrated in an ethanol series to 100% ethanol, followed by 100% acetone and ultimately embedded in the epoxy resin, EM-BED 812 (Electron Microscopy Sciences). Silver to silver-gold sections were cut with a diamond knife, stained with uranyl acetate and lead citrate, and examined with a JEOL 1200 EX II transmission electron microscope.

RESULTS AND DISCUSSION

The surface of the eggs of *Mantispa interrupta* was virtually identical to that of *Chrysopa* species illustrated by Hinton (1981, figs. 50A-E). Figure 1 shows a whole egg in side view. The micropyle is also very similar to the micropyle of *Chrysopa,* and the reticulations of the micropyle are identical to those of the general egg surface. The only published electron micrograph of a *Mantispa* egg is Hinton's fig. 50F, showing a view of the side surface of *M. interrupta.* The reticular surface is clearly identical to that of figure 3 here. Figure 2 shows the base of the stalk and the posterior pole of the egg. As in the *Chrysopa* egg in Hinton's fig. 50E, the reticulations disappear at the base of the stalk, which is featureless at magnification up to 20,000X. Figure 4 shows the details of chorionic structure in cross section. The outer reticulations and inner chorion give no indication of an aeropyle. The reticulations are essentially solid and arise from a solid layer sitting on the inner chorion. The outer portion of the reticulations is more electron lucent than the base, and this less dense appearing material also forms the bridges. The inner chorion consists of two layers of chorionin bridged by pillars. Nowhere in examined sections are there connections between the spaces between pillars and the outside. Similar inner (but not outer) chorionic structure is found in the stick insect *Carausius* (Hinton, 1981, fig. 180A). In *Carausius* the pillars arise from the inner layer and are capped at the outer end. In *Mantispa* the pillars appear to arise from both layers and join in the middle. Hinton (1981) refers to transmission electron micrographs of *Chrysopa,* but does not illustrate them. His statement that "there is no space for a film of air" implies that the outer chorionic layer sits on the inner as in *Mantispa*. To reiterate, the resemblance to the eggs of *Chrysopa* is great. Certainly, on the basis of the ultrastructure of the egg surface of those species of Chrysopidae and Mantispidae examined, one could not distinguish one family from the other.



Figures 1-2. *Mantispa interrupta* egg. 1. Side view of egg, S = stalk, M = micropyle, scale line = 100 μm. 2. Base of egg stalk(s), scale line = 10μm.



Figures 3-4. *Mantispa interrupta* egg: chorion structure. 3. Surface view, R = reticulation, B = bridges, scale line - 1 μ. 4. Section through chorion, see text for detailed explanation, R = reticulation, B = bridge, I = inner chorion, P = pillars, scale = 0.2 μm.

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BOOKS RECEIVED AND BRIEFLY NOTED

THE HOT-BLOODED INSECTS. B. Heinrich. 1993. Harvard Univ. Press. 597 pp. $75.00

This author of *Bumblebee Economics* and *Ravens in Winter* presents here what is now known about thermoregulation in all of the major insect groups, offering new insights into physiology, ecology, and evolution. By describing the environmental opportunites and challenges faced by a wide range of insect life, Heinrich attempts to explain their great variety of physiological and behavioral adaptations for survival in their world.

INSECT PATHOLOGY. Y. Tanada & H.K. Kaya. 1993. Academic Press. 666 pp.

Originally intended as an update of Steinhaus' 1949 text, "Principles of Insect Pathology", this book developed into a new text on insect pathology, on the different types of diseases in insects, and on their biological control. Each of the 16 chapters ends with a very comprehensive listing of additional references.

THE BIOLOGY OF MOSQUITOES. Volume 1. DEVELOPMENT, NUTRITION, AND REPRODUCTION. A.N. Clements. 1992. Chapman & Hall. 509 pp. $99.50

This is the first of two volumes arising from the rewriting of "The Physiology of Mosquitoes", published in 1963, so it is written from the viewpoint of a physiologist. This first volume covers subjects such as genetics, embryology, larval biology, growth & development, metamorphosis, adult physiology, and nutrition of adults and larvae.